DISCUSSION

Mathematical Clubs in the High School. In most of our teachers' meetings, and in our pedagogical magazines, we are putting forth much energy to help the average pupil to a more effective and less difficult method of mastering the requirements of mathematics. We are placing much stress on the *normal;* we are trying by special schools or groupings to help the slightly subnormal towards the " passing grade." Since we are teaching in public high schools which are supported by common taxes and since we are requiring practically all students to take algebra and geometry to secure a diploma, it is clearly our obligation to adjust our curriculum to the student of average intelligence and see that his progress through the school be unhampered by requirements which he cannot meet.

But what provision are we making for those students exceptionally gifted or particularly interested in mathematics, those who perhaps, as scientists and engineers will solve the great industrial problems of the future? Our class work, limited both by time and by the mediocre mentality of each group as a whole, affords no opportunity for the unusual pupil. To meet this need a mathematical society, named the Euclidean Club, is conducted in Scott High School. Only sophomore boys, whose grade in mathematics is A or B, and juniors and seniors who show sufficient interest to profit by membership in this organization, are admitted. A typical program consists of five numbers:

I. Theoretical Subject, as Fourth Dimension, Trisection of an Angle, Non-Euclidean Geometry, Einstein's Theory.

II. Biography of a Mathematician or Scientist: Euclid, Pythagoras, Archimedes.

III. Practical Application of Mathematics. Use of Geometry in the Construction of an Engine; Trigonometry in the Use of Projectiles.

IV. Optional subject, in the nature of a diversion, as Wall Street and the Stock Exchange; Foreign Coins.

V. Scientific or Engineering Subject: American Dyes, Construction of a Submarine, the Panama Canal.

These programs are given entirely by the members themselves. They can secure their material from books in the Scott High School Library, from magazines and from suggestions from the faculty advisor.

Occasionally an evening is given to an outside speaker, a man who has graduated from an engineering school and is engaged in a profession using mathematics. Thus, an alumnus from Massachusetts Institute of Technology spoke on the entrance requirements of his Alma Mater, courses of study, student life and also on Mechanical Engineering as a Profession. A graduate of Case School of Applied Science spoke similarly of his school and on mining engineering.

By this method the boys become familiar with the various branches of applied mathematics, with the varieties of engineering professions, their advantages and disadvantages, and with the nature of schools preparing for that work.

Through this club the boys are able to analyze themselves and to determine, in some measure, their interest in higher mathematics. The benefits of the Euclidean Club are two-fold: Some find their limitations through this introduction into higher mathematics and are thus spared a great folly. Many a bright boy who has been bored by the slow recitation has been interested by the club and has been encouraged to continue his education.

SOPHIA REFIOR

Scott High School, Toledo Ohio

RECENT ARTICLES OF INTEREST TO MATHEMATICS TEACHERS

Education for the Life of To-day: G. L. Cave, of the School Board of Gorham, N. H., School and Society, Vol. XVI., No. 402, p. 281. This gives the views of a layman on present day tendencies and is well worth reading.

Aims in American Education: Honorable Charles Evans Hughes, Secretary of State, Washington, D. C. The Journal of the National Education Association, Vol. XI., No. 7, p. 257. Mr. Hughes calls attention to the fact that the will of the people is the ultimate determining factor in education. Vocational education is not likely to suffer, but education should be broader than this. The foundation of true education should be laid in

a few studies of the highest value in self discipline. He says, "I am one of those who believe in the classical and mathematical training, and I do not think we have found any satisfactory substitute for it. . . . The important point is the insistence of concentration and thoroughness." This article should be read by every teacher.

The Uses of Algebra in Study and Reading: Edward L. Thorndike and Ella Woodyard, of Teachers' College, Columbia University, New York, N. Y. School Science and Mathematics, Vol. XXII., Nos. 5 and 6.

The Present position of the Island Universe Theory of the Spiral Nebulae: Dean B. McLaughlin. Popular Astronomy, Vol. XXX, Nos. 5 and 6. This article shows the amazing rate at which our conception of the vast sweep of the universe has grown in recent months. ALFRED DAVIS

From School and Society for August 5, 1922: Chicago's 10,000 public school teachers and principals are to receive salary increases aggregating $4,250,000 annually, effective September 1. Under the new scale the minimum annual pay of elementary school teachers, of whom there are 8,000, will be increased from $1,200 to $1,500 and the maximum from $2,000 to $2,500; the minimum of high school teachers, of whom there are 1,600 in number, from $1,600 to $2,000 and the maximum from $3,400 to $3,800; the minimum of the 268 elementary school principals from $2,500 to $3,000 and the maximum from $4,200 to $4,800, and the minimum of 23 high school principals from $3,700 to $4,300 and the maximum from $5,100 to $5,700. (ALFRED DAVIS)

Teaching Percentage with the Ruler. Motivation seems to be the most used of any pedagogical term. All teachers who class themselves as professionals *motivate* their class work. Motivation in the teaching of percentage seems to be rather difficult when we look at some of the problems in our arithmetics. For instance, here is a problem from a well known arithmetic: The number of youths of school age in a certain city is 16,767 which is 24½% of the whole number of inhabitants. What is the population of the city? It is enough to scare the pupil. To a little sixth grade pupil, the subject is unadapted. The

difficulty of apprehending such a large quantity, let alone the absurd rate of 24½%, is easily seen.

We must first have the subject matter of our problem close at hand and the per cents should be quantities that are easily reducible to fractions. We are after the method rather than the skill in handling large and complex quantities. The spirit for doing is killed in making the operations difficult. At the same time the sense of values cannot be readily grasped by the pupils.

Arithmetic should be made as concrete as possible. The problems of life are concrete enough. We cannot bring many real objects into the class-room. We cannot bring in bushels of grain, barrels of apples or cords of wood but we can have a ruler, a real live ruler and some yardsticks. The children can see and sense the distance of an inch, nine inches or twenty centimeters. Here is something real within the reach of every teacher. It is much more interesting to have the concrete thing than to talk about it without its being present.

In teaching percentage the writer has found no better means of motivation and of making it a live issue than to use the ruler. In the first place per cent is only another means of expressing fractional parts. It seems to be more dignified to say ten per cent than to say one-tenth. To the pupil it is only acquiring a new language and an understanding of that language in terms already learned.

They have the ruler. It is easy to see that two inches is one-fourth of eight inches, that six inches is three-fourths of eight inches, etc. Put you finger on eight inches. What part of eight inches is one inch? Two inches? Three inches? Four inches? Six inches? Seven inches? Slide the other hand along the ruler as you go.

Put your finger on twelve inches. What part of twelve inches is one inch? Two inches Three inches? etc. Keep at this drill. It never grows monotonous for the children. They like it and call for more.

Perhaps some will not respond to the question: What part of twenty-four is eighteen? Have the pupils do this. Put your finger on six inches. What part is that of twenty-four? How

many six-inch spaces are there up to eighteen inches? Answer three. Then three-fourths will come. Continue drilling by skipping about with different units as a base.

The second thing to do, if the aliquot parts have been learned by the children is to have them translate one-fourth into hundredths and then to per cent, recalling that per cent means by the hundredths. Get these translations of fractions memorized, especially the common ones which we use most.

The third thing. Using the fractional part as a bond, go over the same questions, starting thus:— Now, instead of saying what part of eight inches is one inch, we can just as well say what per cent of eight inches is one inch. Two inches? Three inches? Etc. Think it thus; one is one-eighth of eight inches; one-eighth is 12½%. What per cent of five inches is one inch? Two inches? Three inches? Four inches? In using the length twelve inches or any length where the parts do not result in the usual aliquot parts, write on the board the numbers you wish to use. As for twelve use, one inch, two inches, three inches, four inches, six inches, eight inches, nine inches, ten inches. It is unnecessary to teach 41⅔%, 58⅓% and 91⅔% in the sixth grade.

Always have each pupil follow the one reciting with their rulers. They should slide their fingers along the ruler keeping one hand at the length being used.

To teach the second type of percentage problems is no more difficult. What is one-twelfth of twelve? One-eighth of twelve? One-sixth of twelve? One-fourth of twelve? One-third of twelve? One-half of twelve? Two-thirds of twelve? Three-fourths of twelve? What is 8⅓% of twelve? 16⅔% of twelve? Etc. Have the pupils find the distances on their rulers.

The last type of percentage problems—ratio, and percentage given to find base, is hard to get over in the ordinary way but with the aid of the ruler it is very easy. If two inches is one-fourth of the distance, what is the whole distance? Etc. Two inches is 25% of what distance? Three inches is 25% of what distance? Etc. Starting with one inch, using 25% go the whole length of the ruler or yardstick. Use at first all the per cents whose fractional equivalents have one for their numerator, as

8⅓%, 12½%, 16⅔%. Drill these thoroughly before going on.

Start with 66⅔% or 75% next. 66⅔% is two-thirds. Four is 66⅔% of what distance? Four is two-thirds of the distance. One-third of the distance must be two inches. The whole distance must be six.

The children should at all times indicate with their fingers the distances. This is very important. By doing this the children group and fix in their minds the operations. The contacts are three-fold,—intellectual, visual and motor. Movement aids in interest. When the pupils have mastered the language and the operations in all types of problems in percentage, one may give problems whose answers are mixed numbers.

NATHAN R. HOWELL,
East Moriches, N. Y.